Mapping Federal Lands using MASTER data

Gunnison Gorge National Conservation Area

by
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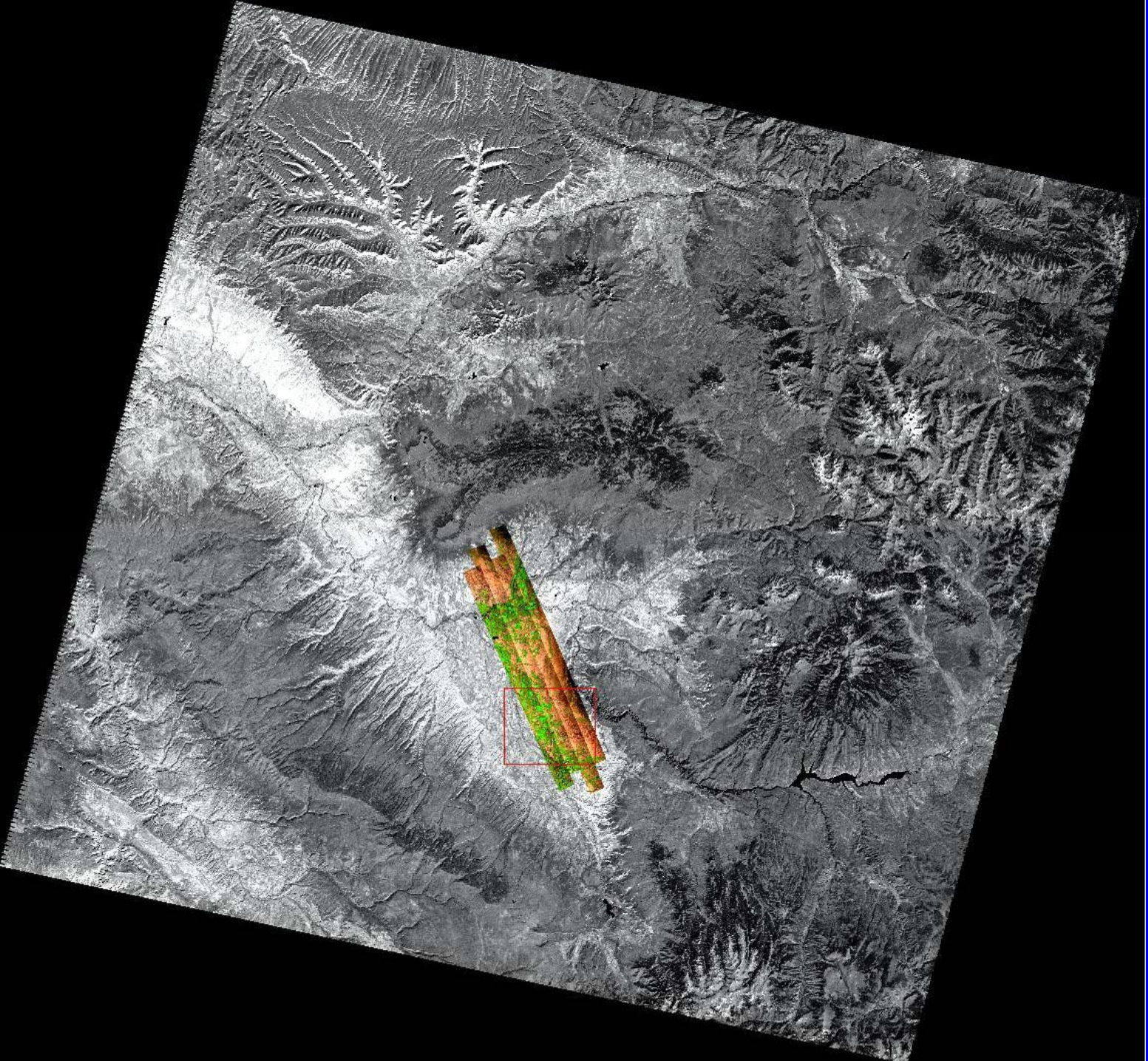
Introduction

- Integrated USGS/BLM Study:Gunnison Gorge NCA
- Characterize Surface Materials to correlate with:
  - Land use issues
    - Grazing, off-road use, groundwater salinity
  - Geochemistry of the Mancos Shale
    - Metals (Cretaceous black shale)
- Propagate Findings and Associations to New Areas

Overview

- Ongoing Remote Sensing Investigation
  - (work in progress)
- MASTER Data Characteristics
- Material Mapping Techniques
- Mapping Results
  - VNIR-SWIR (reflectance data): FeOx, clay, carbonate
  - Thermal-IR (emissivity): Quartz, Feldspar, Mafic Mins.



NASA/JPL

MASTER flightlines

overlain on

Landsat TM

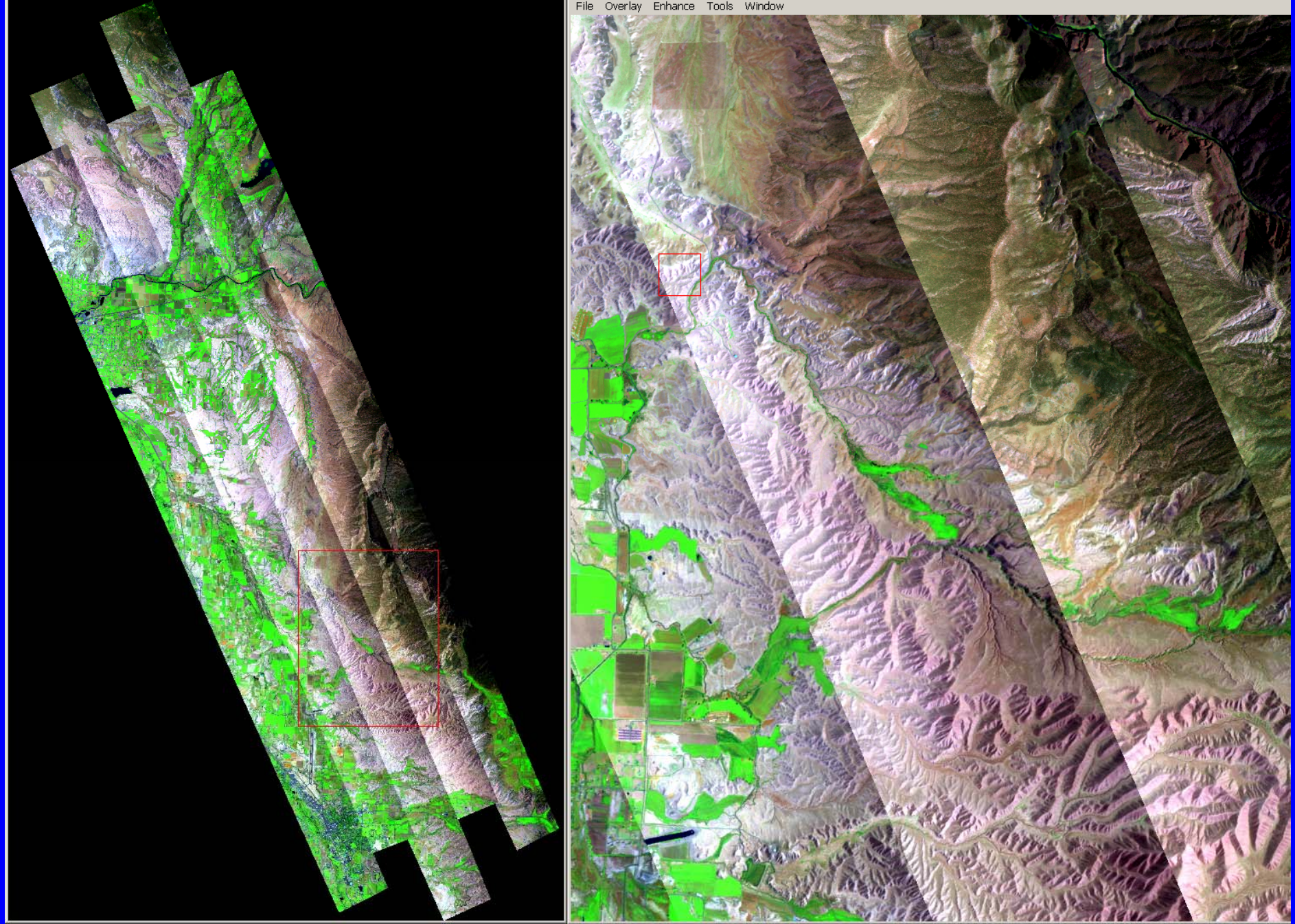
Aircraft data

50 Channels

Vis-SWIR

Thermal-IR

4 M Pixels



MASTER flightline Mosaic (lines 2-6)

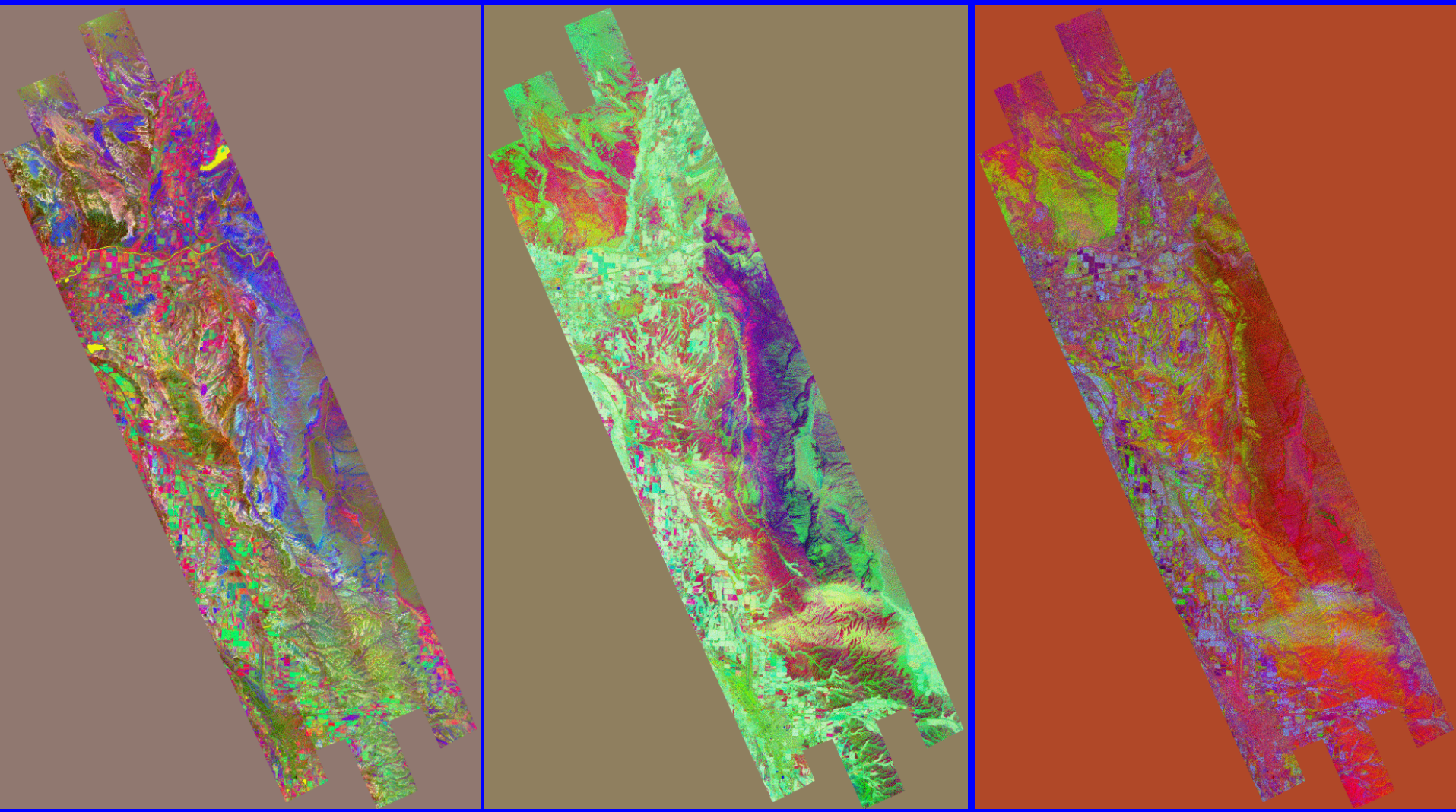
Master data – Non-geocorrected

Master data - geocorrected

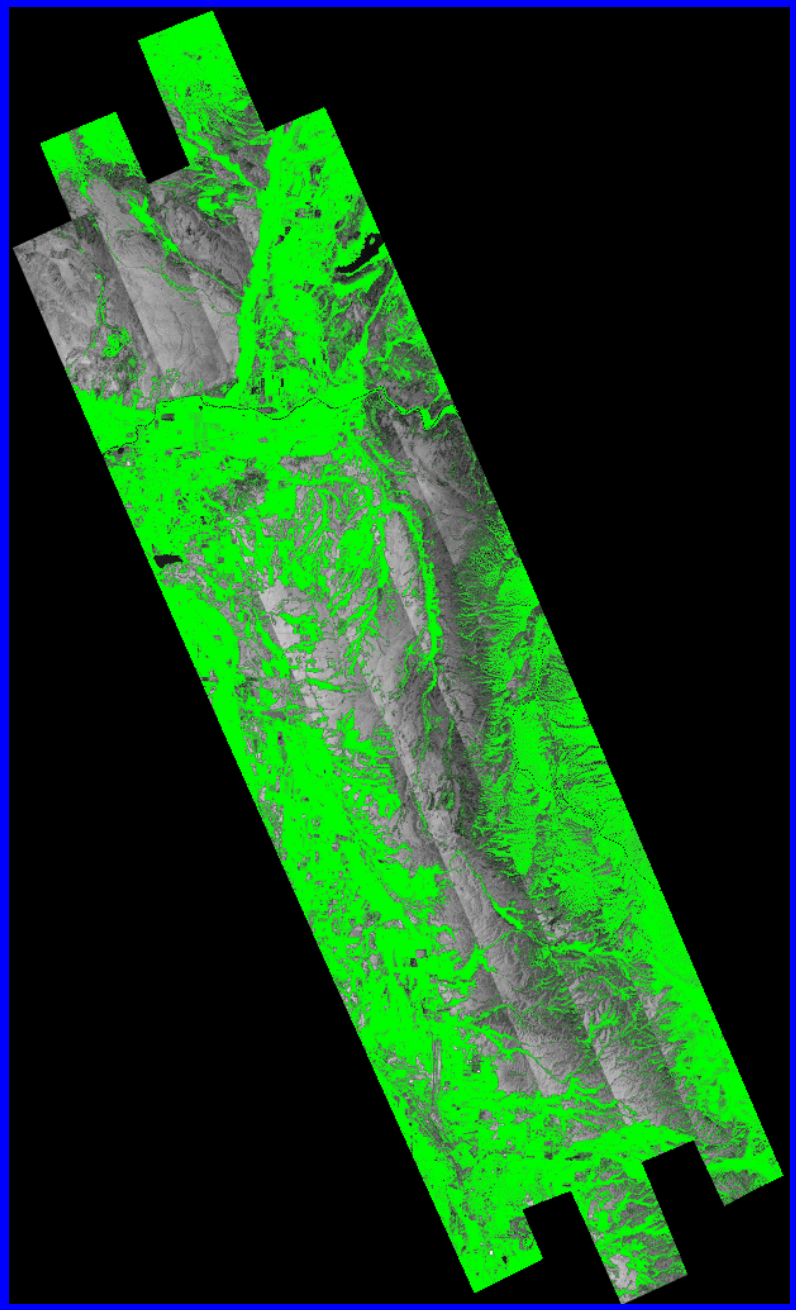
Mapping – VNIR - SWIR

- 1) Spectral Variability Examined – Principle Components
- ----------
- 2) Material Mapping (Identification)
  - R-square spectral mineral identification routine
  - Based on: spectral material library
  - Compares MASTER spectral absorption features with library
  - Best material ‘fit’ assigned to tested pixel (pixel independent)

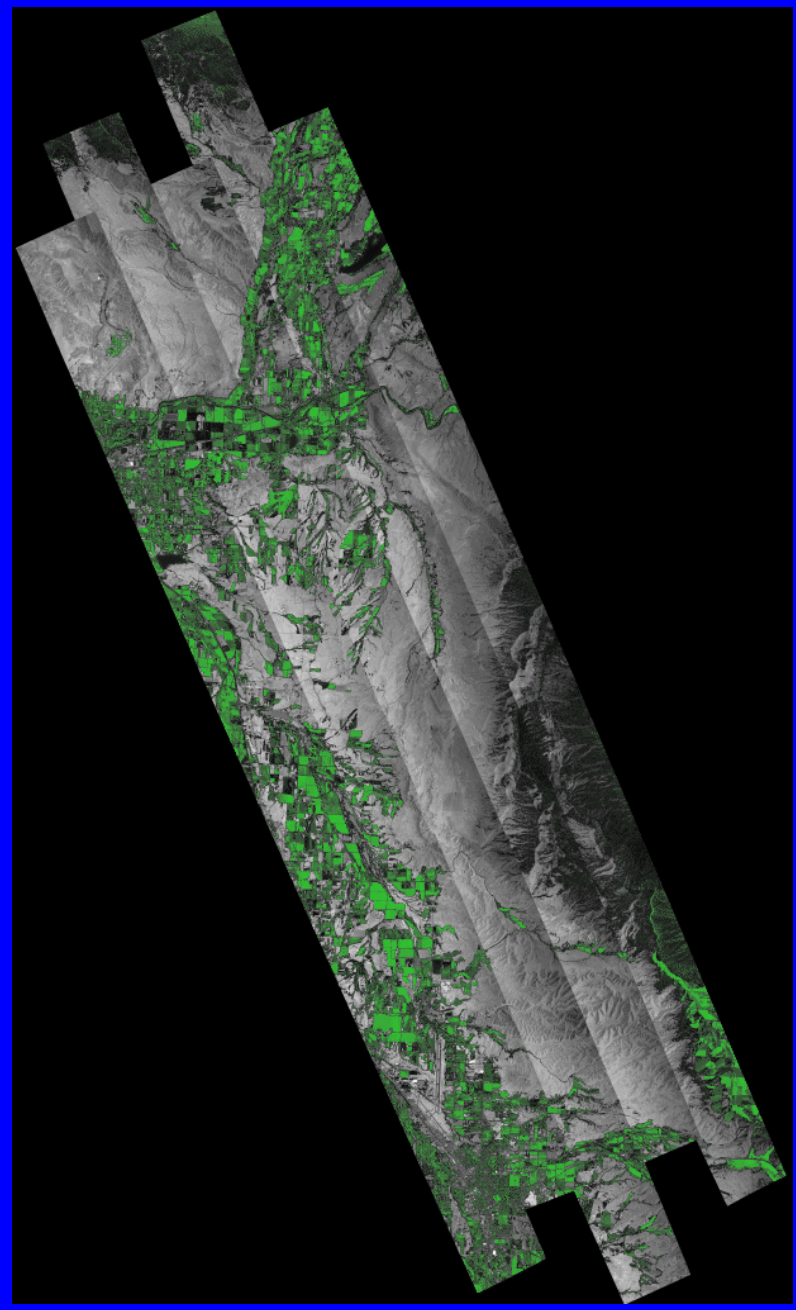
- R-square Fit Routine requires:
  - Data calibrated to ground (absolute) reflectance
  - Absorption continuum removal (normalization)
  - Continuum end-points specific for each material test



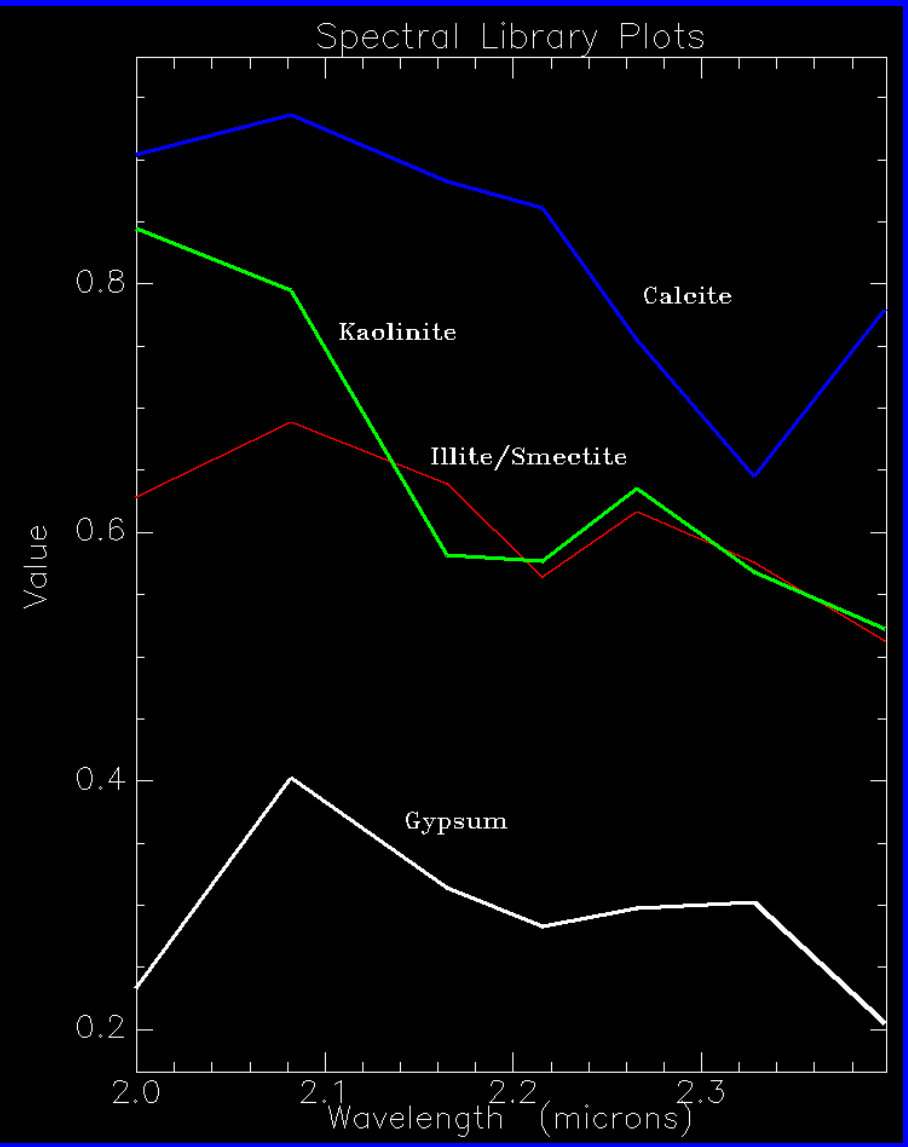
MASTER Principle Components – showing spectral variability



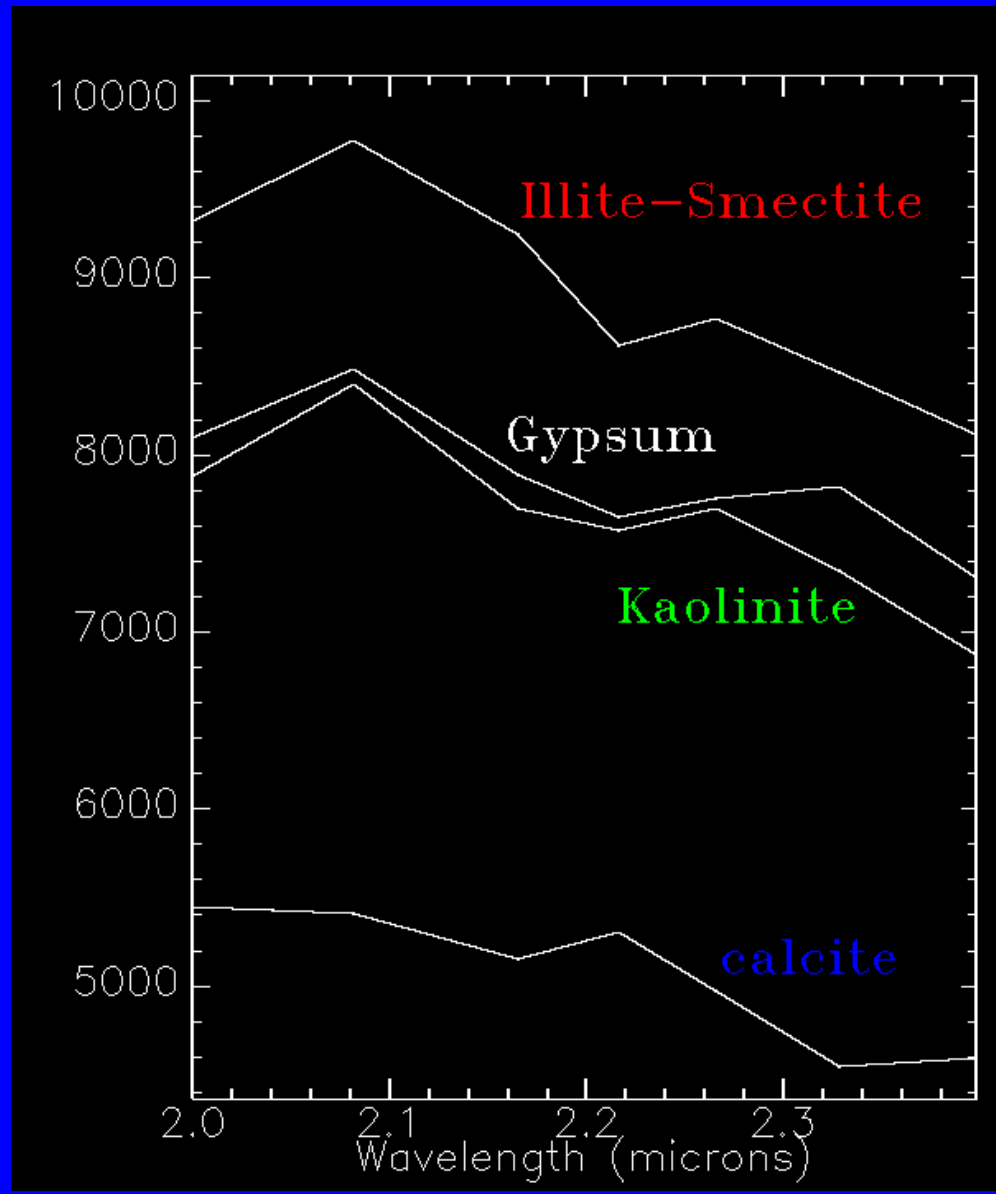
MASTER Vegetation (all)



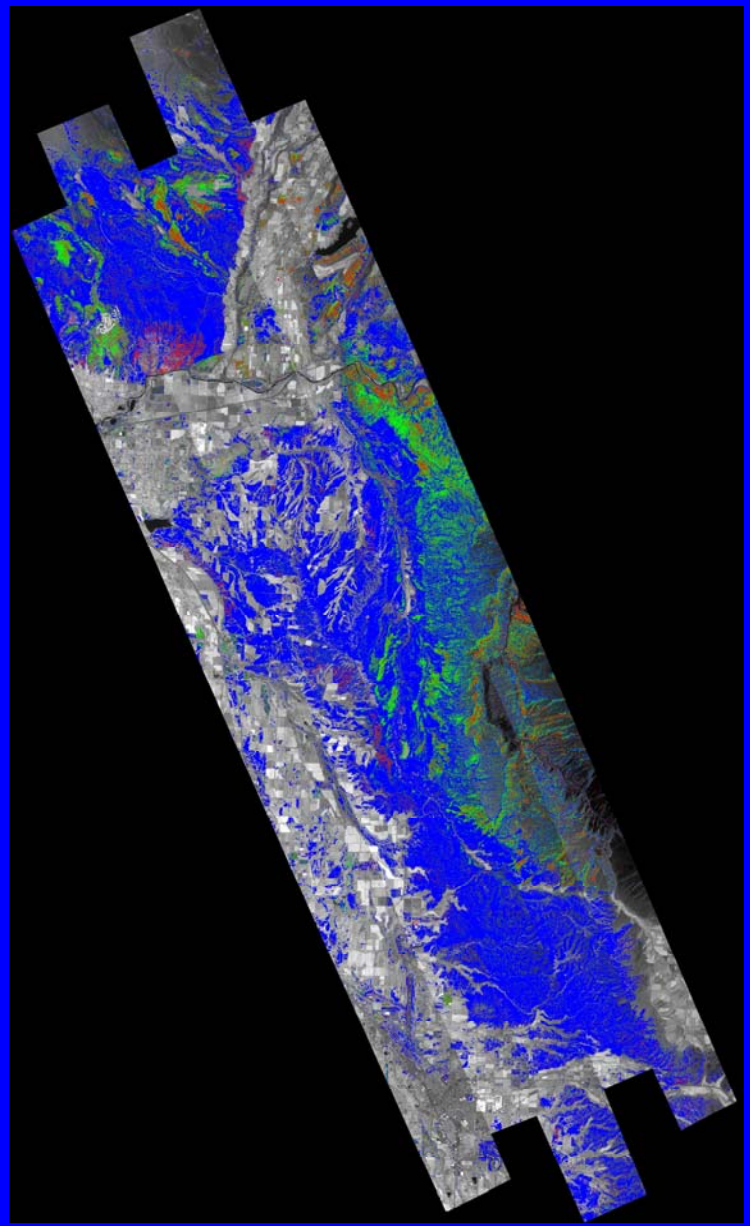
Vegetation Intensity

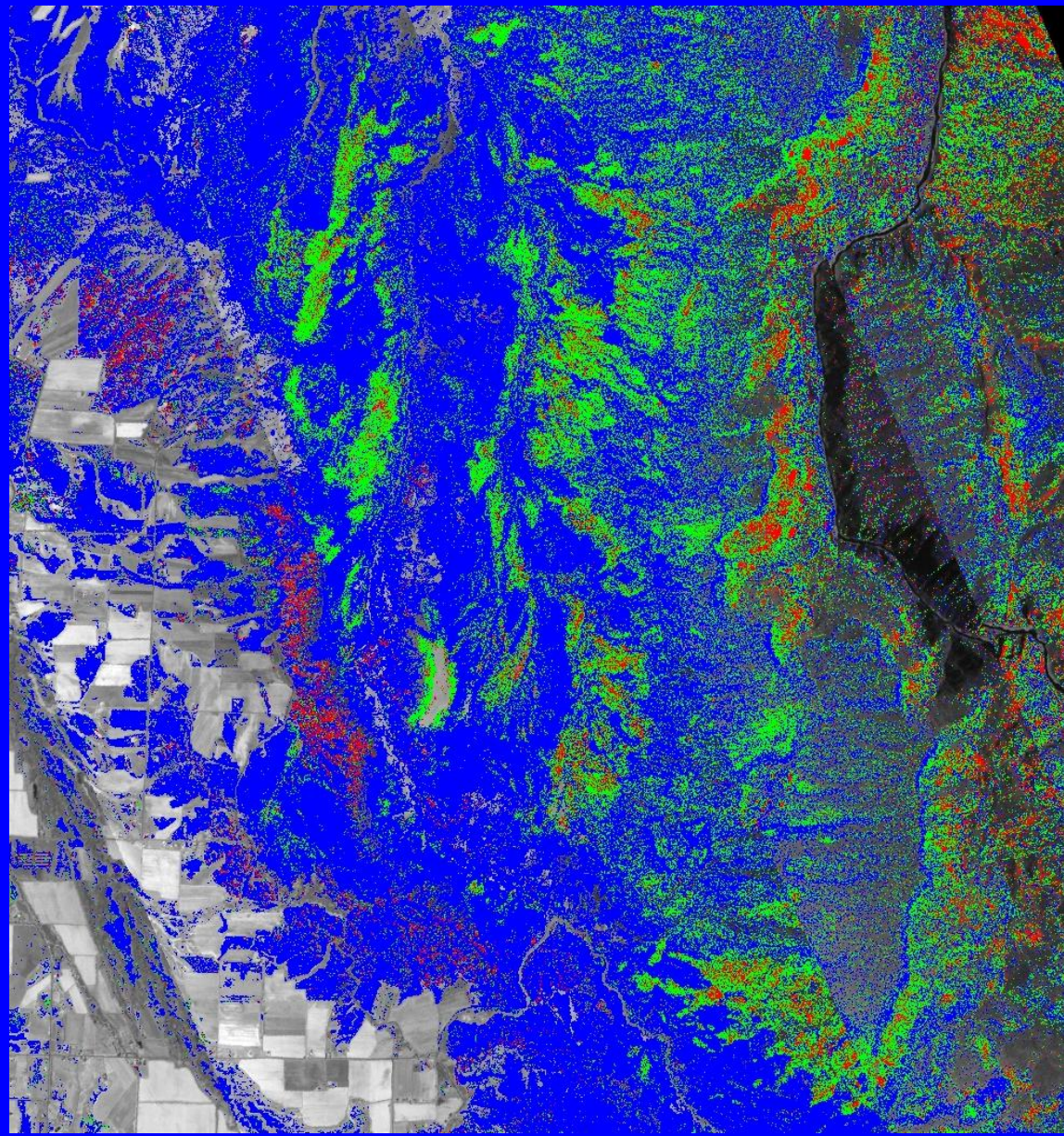


Library Mineral Spectra

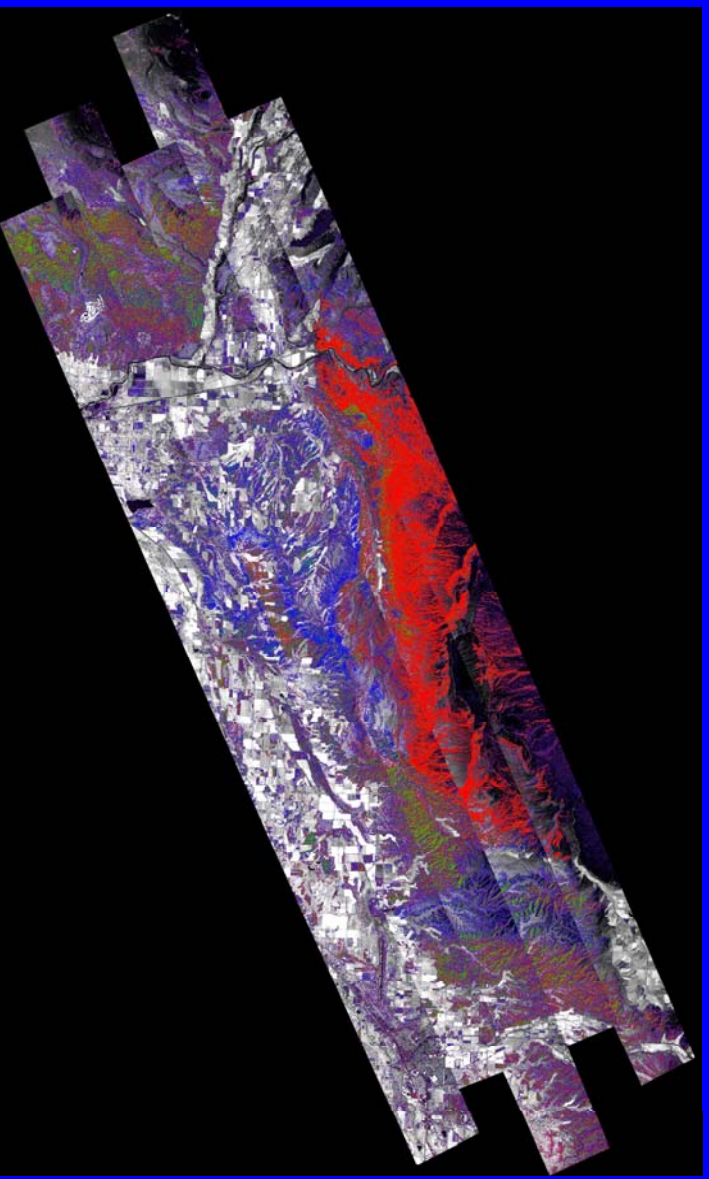


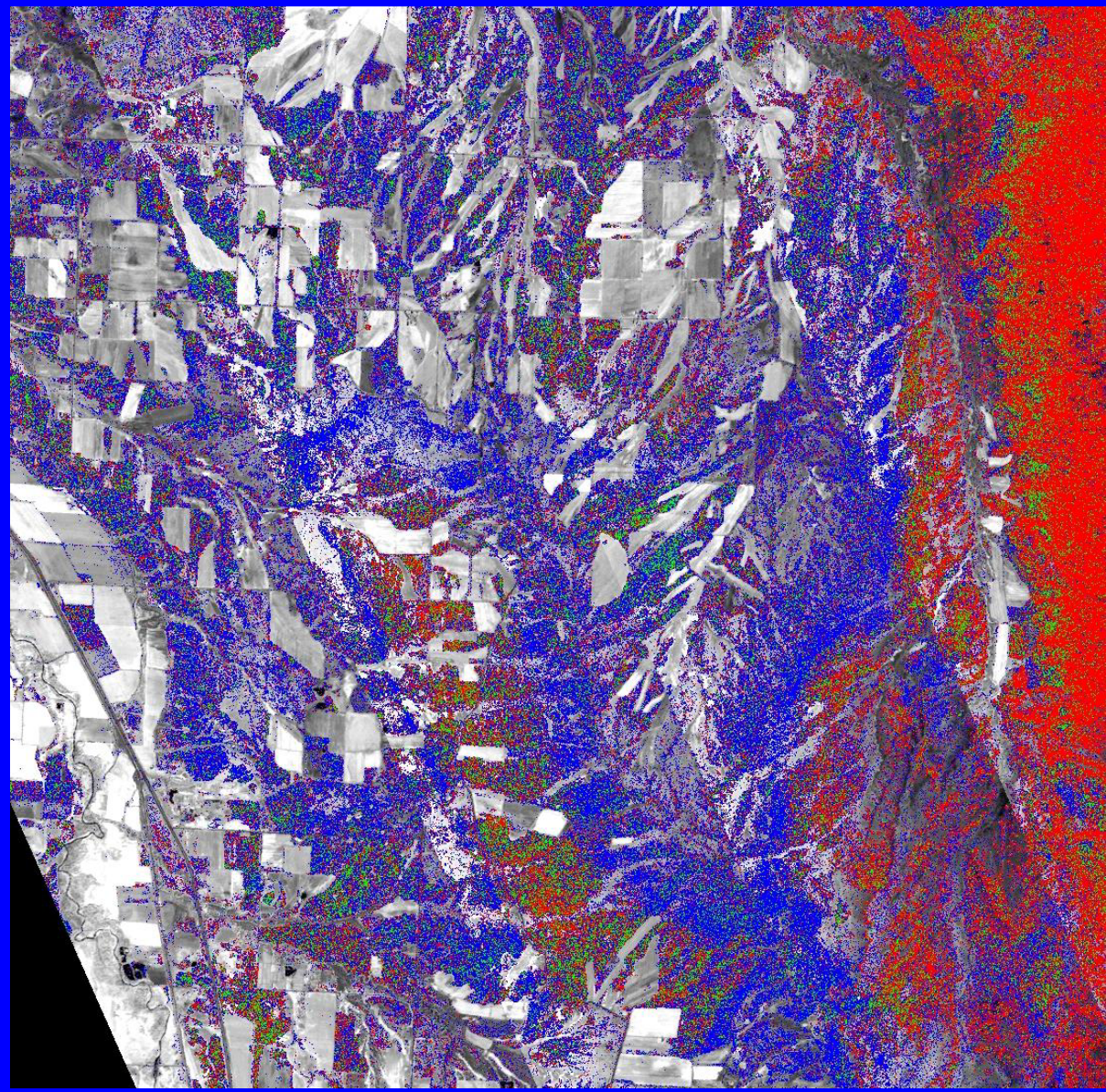
MASTER data Mineral Spectra



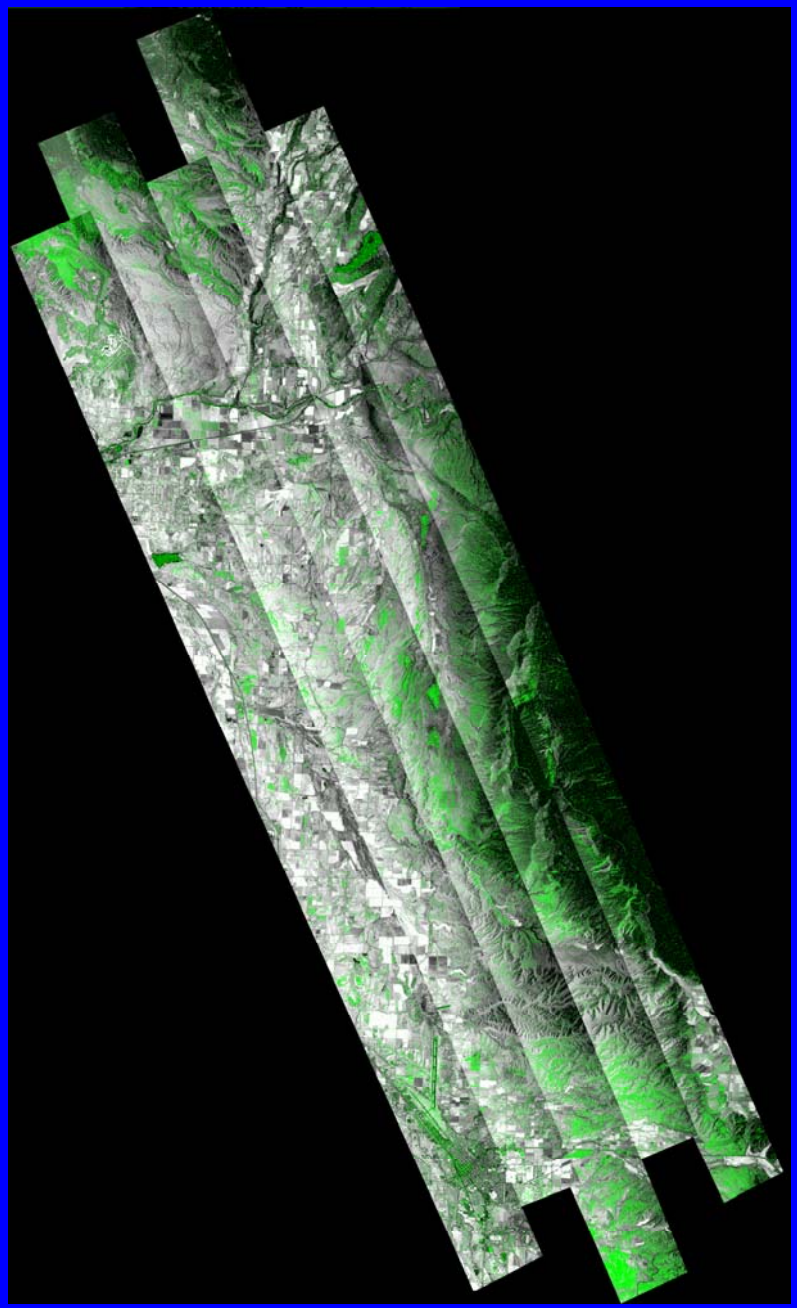


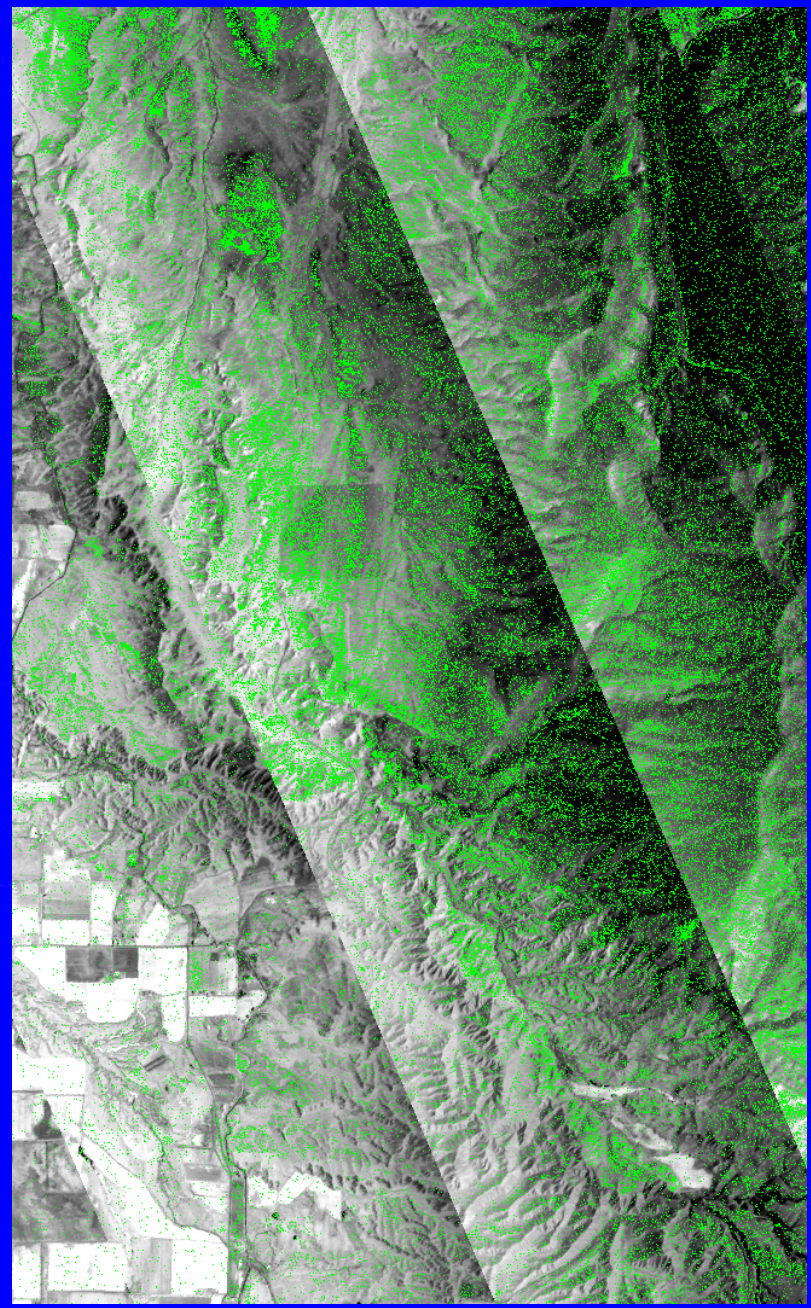
MASTER Iron Oxides: hematitic-red, goethitic-green, lt. goethitic.-blue





MASTER Clays: kaolinitic-red, mixed-green, illite/smectite-blue



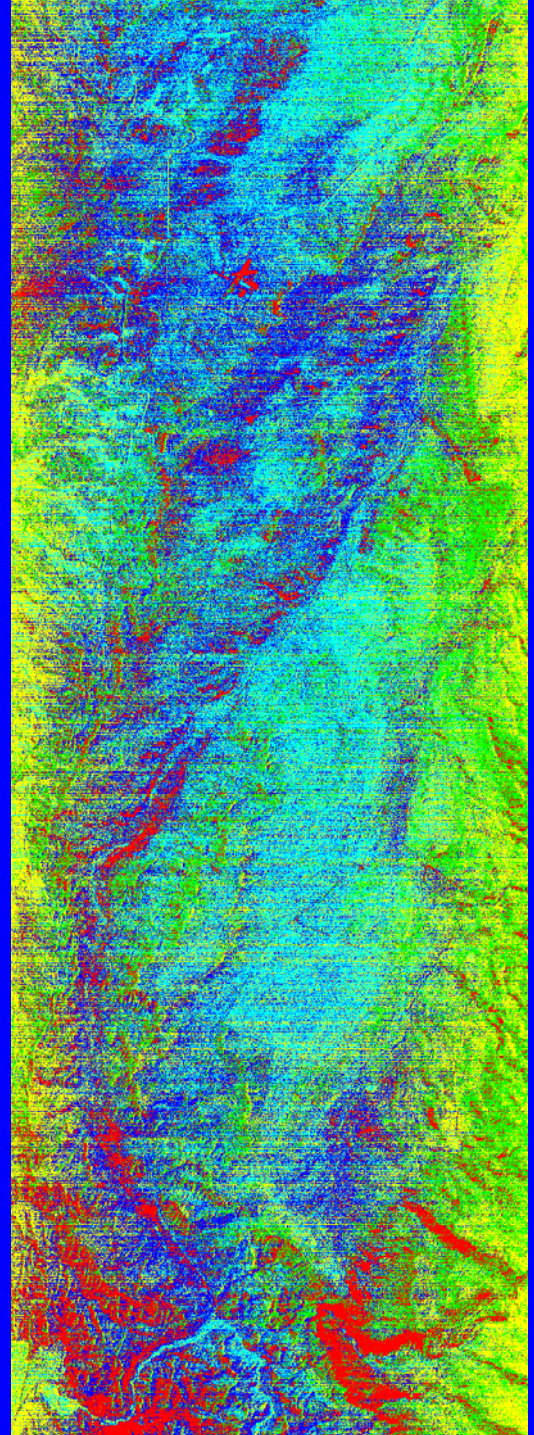


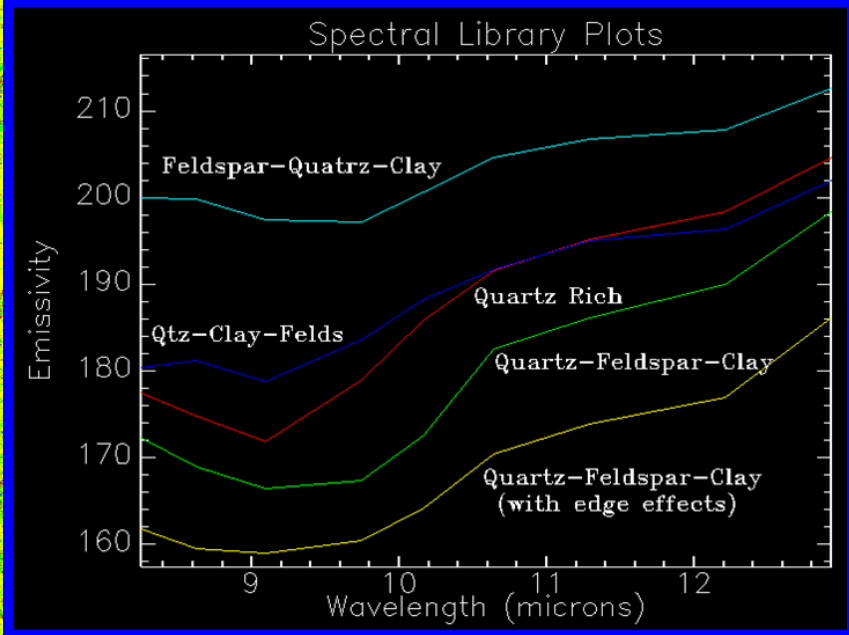
MASTER Carbonate + cryptobiotic soils & some dry vegetation

Mapping – Thermal-IR

- Material Mapping (classification)
  - Isocluster classification routine
  - Class spectra visually compared and identified (mineral mixtures)
  - Material class statistically derived (pixel dependent)

- Isocluster classification requires:
  - Data calibrated to relative emissivity
  - Common rock-forming spectral emissivity library (with mixtures)





Color Infrared Composite (left)

Thermal IR Classification Image (right)

Conclusions

- MASTER data results fall between:
  - Hyperspectral mineral identification and
  - Landsat material classification
- Preliminary Soils Characterization
  - Reflectance wavelengths: iron-oxides, clays, & sulfates
  - Thermal wavelengths: rock forming minerals
- MASTER data proved very useful in:
  - Locating material changes within the Mancos shale
  - Identifying certain mineral groups